After Action Report
for the
2011-2012 Prescribed Fire
Grass Plots Project

Naval Auxiliary Landing Field
San Clemente Island, California

Final
October 12, 2012

Prepared for:

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Under Contract with:

Naval Facilities Engineering Command, Southwest
Coastal IPT/Code: ROPMA
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Contract N62473-11-D-2225 Delivery Order 0003

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Cover Photo by Wendy Pearson, 2012

Executive Summary

San Clemente Island (SCI) has been substantially impacted in the last century by human activities, resulting in the introduction of a number of non-native plant and animal species, including goats. In the early part of the 20th century, the island was heavily used for sheep ranching operations. When the Navy took over use of the island in 1934, leases for sheep ranching were cancelled. Without control by the sheep ranchers, the goat population proliferated and likely peaked in the late 1970s and early 1980s, which resulted in significant damage to the native plant and animal communities and the federal listing of several species under the Endangered Species Act (USFWS 1984). In response, the goat population was completely eradicated by 1992 (DoN 2001). Today, SCI is a key training range within the SOCAL Range Complex and is the Navy's only remaining ship-to-shore live firing range (DoN 2001).

The natural fire regime on the island has been affected by its use as a Navy training range and by the vegetation changes resulting from previous ranching and grazing activities. Accidental fires are set incidental to training activities and have played a large part in the history of SCI since the Navy began using it (See Attachment 1). In addition, intentional fires are periodically set as fire breaks. Following consultation with the U.S. Fish and Wildlife Service in 2008 and the Navy's approval of a comprehensive Fire Management Plan in 2009, the Navy agreed to investigate the application of Prescribed Fire as a tool in the restoration of SCI's native plant population. Until the current studies, prescribed burning had only been used in two other instances on SCI: once in the Missile Impact Range to demonstrate effectiveness of PHOS-CHEK fire retardants and again to expose unexploded ordnance on a 160 acre site in SHOBA, following application of PHOS-CHEK fire retardant around the perimeter.

The prescription burns being done to support studies by both the United States Geological Survey and San Diego State University were coordinated by Dr. Dawn Lawson from SPAWAR. The studies are being done to provide a better understand the effects of fire on SCI vegetation so that more accurate effects analyses can be done and so that appropriate prescribed fire and firefighting strategies can be developed and employed. Study plots were located in boxthorn and grassland habitats. Boxthorn habitat was of particular interest in investigating fire effects on plant communities because of its importance to the endangered San Clemente Island sage sparrow, its unknown burn response, and its involvement in accidental burns on coastal terraces important in high value training areas. Both studies required the application of small controlled burns. Tierra Data Inc. was contracted by the Navy to develop and implement a prescribed burn plan to facilitate completion of these studies. A critical factor in the success of this project was the clear identification of objectives and the careful design and implementation of the prescription by well-trained and experienced personnel. This project resulted in the successful implementation of the plan and hand burning of 51 grass study plots, demonstrating the utility and safety of prescribed burning for the removal of native and non-native vegetation on SCI.

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1.0 Introduction

Under Contract N62473-11-D-2225 Delivery Order 0003, Tierra Data Inc. (TDI) was contracted in 2011 to prepare and conduct a prescribed (Rx) burn on thirty 15-meter by 15-meter plots for the U.S. Geological Service (USGS) and three 1-acre plots for San Diego State University (SDSU) on San Clemente Island (SCI). The USGS plots were originally located as follows: ten plots on Buds Road along with ten control plots; ten plots on Dump Road along with ten control plots; and ten plots on Horton Road along with ten control plots. One large SDSU 1-acre plot was located at the Windmill Site and two 1-acre plots were located near Dump Road, near the main road (Ridge Road).

This project was scheduled for completion the week of 8–16 June 2011; however, dense marine air blanketing the entire island and scheduling conflicts on the one day with favorable weather conditions (14 June) prevented burning. On 15 June, most of the island was again under a fog layer except for the Horton Road plots. Weather readings indicated high fuel moisture and very high humidity, which was in the very low end of the prescription. Following briefings, safety checks, and application of the PHOS-CHEK Insul-8 gel/water, the first test burn was initiated. The grass fuels were still damp and did not burn well. Two additional test plots were burned after waiting for the weather to improve. At approximately 1500 hours the marine air began moving in and the day time temperature plummeted. Further observation indicated that most of the seed had already fallen from standing stems of cured grass and that very little of the seed was consumed in the test burns. One of the project goals was to consume as much of the seed as possible, while still on the plant. Based on the weather and results of the test burns, the Navy and USGS decided to cancel the burning project for 2011 and reschedule it for the following spring.

During the winter of 2011 and 2012 the size of the planned project grew from 30 USGS plots to 50 plots. SDSU continued with three plots but changed their location and configuration. The 50 USGS plots were located as follows: fifteen 10-meter by 10-meter plots were located at the Windmill Site, fifteen 10-meter by 10-meter plots were located on Buds Road, and 20 plots were located along Horton Road. The three SDSU plots were located off of Dump Road. The Windmill and Buds plots consisted of annual grasses and light to heavy patches of California boxthorn (*Lycium californicum*). The SDSU plots off of Dump Road and Horton Road plots were vegetated with perennial grasses (i.e., purple needle grass [*Stipa pulchra*]), some California boxthorn, coyote brush (*Baccharis pilularis*) and morning-glory (*Calystegia macrostegia*).

The persistent marine layer that delayed the project in 2011 did not occur during the week scheduled for the Rx Burn in 2012 (4–8 June), resulting in the burning of 51 plots within prescription and the fulfillment of the following primary objectives:

Primary Objective 1. Develop information on the response of California boxthorn, a key species in SCI sage sparrow habitat.

Primary Objective 2. Document site recovery on each of 53 inventoried experimental grass plots by on-site native grasses, and/or occupation by invasive non-native species, following the burning of each plot using Rx Fire.

Primary Objective 3. Determine the effects of fire on exotic annual grasses and native perennial grasses.

There were also two secondary objectives:

Secondary Objective 1. Determine the effectiveness of a new PHOS-CHEK product, Insul-8 Gel Concentrate, for use in keeping adjacent dry grass and other vegetative fuels from igniting, during the Rx burning of immediately adjacent fuels using high intensity fire. This product was approved in 2011 for use by the U.S. Forest Service after extensive testing.

Secondary Objective 2. Provide structured training opportunities in the use of Rx Fire for selected Federal Fire Personnel.

2.0 Methods

2.1 Plot Design

The design of the burn and control plots was determined by USGS and SDSU personnel. Prior to installation each proposed burn plot and the immediately surrounding area was cleared by Unexploded Ordnance (UXO) Technician, Tom Lee, for undetected UXO. Once cleared for UXO, fifteen 10-meter by 10-meter plots were located at the Windmill Site, fifteen 10-meter by 10-meter plots were located on Buds Road and twenty 10-meter by 10-meter plots were located along Horton Road. The three SDSU plots were located off of Dump Road. Two of the SDSU plots were 60-meter by 60-meter squares and one plot was 30 meters by 120 meters. Each individual plant was inventoried on each plot using GPS coordinates. A 2-foot wide fireline was weed whacked around each and every burn plot. Due to late spring rains and a resurgence of new grass growth the firelines around these burn plots had to be weed whacked at least twice.

2.2 Required UXO and Safety Briefings

The safety briefing and UXO training were held in the Commons Meeting Room on SCI at 1030 hours on 4 June 2012 with Commander Walter Glenn and the USGS and SDSU personnel to discuss the approved Rx Fire Plan. All required personnel were present for the safety briefing and UXO training (Photo 1 and 2).

2.3 Natural and Cultural Resources Avoidance

Each proposed burn plot was checked for both natural and cultural resources within each of the plot boundaries. Since the project occurred within the MBTA breeding season, a TDI Staff Biologist physically checked each plot and the immediately adjacent areas for nesting birds, prior to spraying the fireline and outer perimeter with PHOS-CHEK Insul-8 gel/water mix and after burning each plot. During the course of the project, two horned lark (*Eremophila alpestris*) nests were discovered near the Buds Road plots and flagged to avoid accidental destruction during project activities. In addition, one island night lizard (*Xantusia riversiana*), a federally listed species, was killed during the firing of one plot on Horton Road. This was reported to the Natural Resources Office.

Photo 1. Safety briefing with Commander Walter Glenn, Federal Fire, USGS, SDSU and Navy natural resource personnel.

Photo 2. Mandatory UXO Briefing for all off-island Burning Team personnel by UXO Technician, Tom Lee.

2.4 PHOS-CHEK Insul-8 Gel Concentrate

There are a number of PHOS-CHEK products that can be used to support Rx Fire Operations, which reduce the flammability of adjacent fuels. PHOS-CHEK Insul-8 gel concentrate is a newly developed and approved product that is very easy to mix and apply. PHOS-CHEK supplied and covered all shipping costs for the PHOS-CHEK pump and provided a PHOS-CHEK Technical Representative to insure the product was properly mixed and applied. Twenty 5-gallon containers of PHOS-CHEK Insul-8 Gel Concentrate were purchased from ICL Performance Products at a cost of $320.00 each

and shipped via the barge to San Clemente Island. For proper application the water hardness must be known. Samples of water shipped to SCI from Naval Base San Diego tested out at 171 parts per million. The Insul-8 gel/water mix was batch mixed in a PHOS-CHEK 200 gallon tank with a re-circulating pump at the rate of 1 gallon of Gel Concentrate to 100 gallons of water. The pump was supplied with a nozzle. Federal Fire supplied 450 feet of 1½ inch fire hose. Depending upon the day time temperature and relative humidity, the Insul-8 gel/water mix is effective for up to an hour or more.

2.5 Mixing Location

The product is easily transported in 5-gallon containers and mixed on site (Photo 3). This requires a support vehicle, such as a water tender for a ready and available water source. Federal Fire Crash-Rescue Truck 37 was used for this purpose until it was replaced by Engine 112 following an electrical problem on 6 June (Photo 4 and 5).

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Photo 3. PHOS-CHEK Insul-8 Gel Concentrate comes in easy to handle 5-gallon containers.

Photo 4. Crash Rescue 37 is used as a water tender for on-site water supply.

Photo 5. Crash Rescue 37 holds 1,000 gallons of water, which makes 5 tank loads of PHOS-CHEK Insul-8 gel/water mix.

2.6 *On-Site Safety Briefings*

Once on site the first order of business is a briefing of all participants. The approved prescription was handed out to each participant and reviewed in detail (Photo 6). The purpose of the briefing was to answer questions; clarify assignments; perform a communications check; and determine vehicle staging and the escape plan, including a dry run, for use in the event things went awry.

Photo 6. On-site briefing on 5 June 2012 at the Horton Road Plots located in thick continuous stands of perennial grasses.

2.7 Burn Plot Preparation

Prior to burning, it was first determined that the project was in prescription, which included verifying that all weather parameters were within the approved prescription matrix developed using BEHAVE Plus Version 5.02, a USDA Forest Service Research Product developed in the late 1970s to predict wildfire rates of spread, flame length, and intensity. BEHAVE has been updated and enhanced and is widely used by all wildland fire agencies. In addition to the weather parameters and long range forecast, all of the fire equipment, communications equipment and personnel called for in the plan were available. This included the budget for the project and funds to cover any escape costs. Once the determination was made that the project was in prescription the following preparation steps were initiated:

1. Range Control was notified that we were in prescription.
2. Weather readings were periodically taken to ensure the project stayed within the approved prescription matrix.
3. Test Burns were set up to ensure the vegetation would burn in a way that met or exceeded the project objectives as described in the three following steps (a–c):
   a. Control lines (firelines) were weed wacked down to mineral soil and cut vegetation was removed (Photo 7).
   b. Control lines and adjacent vegetation on the outer perimeter of the burn plot were sprayed a distance of 10–15 feet with PHOS-CHEK Insul-8 gel/water mix (Photo 8).
   c. The sprayed Test Burn Plot was then ignited (Photo 9).

Photo 7. A cleared fireline is weed whacked around each test burn area and cut vegetation is removed (photo by Michael J. Rogers, 2012).

Photo 8. The weed whacked fireline and adjacent vegetation is sprayed with PHOS-CHEK Insul-8 gel/water mix (photo by Dr. Dawn Lawson, 2012).

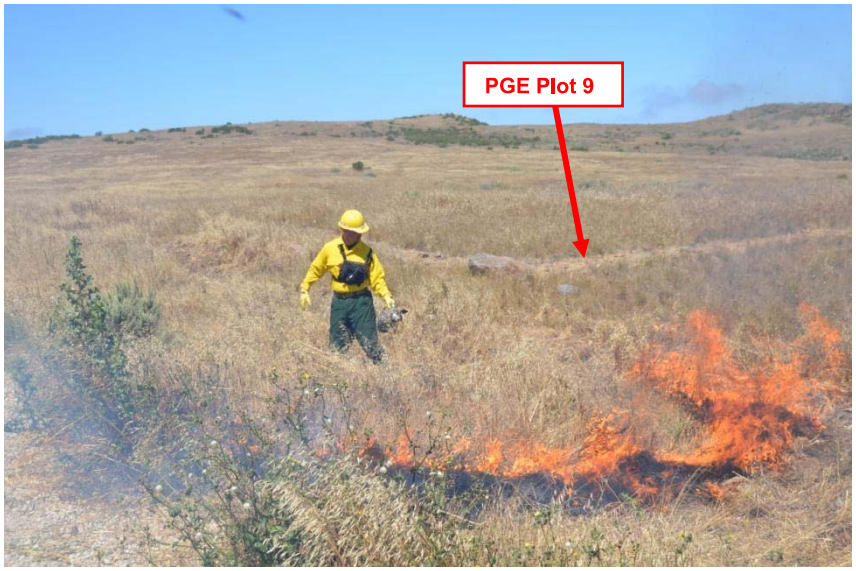

Photo 9. The first test burn area is ignited to test fuel consumption, fire behavior, wind direction, and smoke dispersal.

2.8 The Importance of Test Burns

The first test burn revealed critical information regarding the application of Insul-8. The firelines surrounding the test burn were not sufficiently sprayed with Insul-8. As a result, the fire crept beneath the Insul-8 treated thatch and crossed both the western and eastern outer perimeters to burn through the second test plot on the west side (Photo 10) and into standing perennial grasses sprayed with PHOS-CHEK Insul-8 gel/water mix on the east side (Photo 11).

Photo 10. The first test burn, shown on the right side of the photo, burned through the inadequately weed-whacked fireline and ignited the second Test Plot in two locations.

Photo 11. The fireline and adjacent smoldering perennial grasses that were sprayed with the PHOS-CHEK Insul-8 gel/water mix.

Following the first test burn, it was apparent that a heavier application of Insul-8 surrounding the fireline and adjacent vegetation was needed given the amount of thatch that was remaining on the weed-whacked lines. The area shown in Photo 10 was contained by the fireline around Test Plot 2. The area shown in Photo 11 required a thorough mop up to ensure the fire was fully extinguished (Photos 12 and 13).

Photo 12. The amount of thatch build up on the soil surface and amount of mop up required to ensure the escaped fire was fully extinguished.

Photo 13. The amount of mop up required to ensure the escaped fire was fully extinguished.

A final test plot was prepared to demonstrate the effectiveness of PHOS-CHEK Insul-8 by laying out a circle with highly visible orange flagging and then spraying the outer perimeter with Insul-8 without first creating a weed-whacked fireline (Photo 14). The resulting fire burned all fuels within the circle and went completely out once it reached the sprayed perimeter (Photo 15), conclusively demonstrating the effectiveness of PHOS-CHEK Insul-8 Gel.

Photo 14. PHOS-CHEK Technical Rep, Jim McCarter, personally directs the application of the Insul-8 gel on the third test area to ensure sufficient application.

Photo 15. The resulting burn remains completely within the sprayed area.

3.0 Results

All 50 of the USGS Grass Plots and the largest of the SDSU plots were burned from 5-7 June 2012. Strong winds on 5 June resulted in only one plot burned before wind speeds were too high to stay within prescription. This left two days, 6–7 June, to burn the remaining plots. The Navy made the decision to prioritize the USGS plots, beginning with Horton Road. Fortunately, the strong winds subsided around 0400 hours the morning of 6 June resulting in excellent burning conditions for the remaining days. On 6 June the remaining 19 plots on Horton Road were burned. The following day (7 June), the 30 plots at the Windmill Site and Buds Road were burned. The 50 USGS plots were completed by 1400 hours on 7 June, leaving a couple of hours with excellent burning conditions. SDSU Botanist, Emily Howe, was notified around 1200 hours that there would be time to do some of the SDSU plots. Emily determined that the larger plot was a top priority for burning. The much larger size and configuration of the SDSU plots required more time by the burning team to treat the fireline and outer perimeter with PHOS-CHEK Insul-8. Following a project briefing and Test Burn the first plot took just over an hour to pre-treat. Burning and retrieving all of the necessary hose was completed by 1700 hours, at which time weather conditions were beginning to deteriorate. In addition, Brush 112 developed an electrical problem during the prior burn and was no longer fully operational. This meant that there would not be adequate resources for burning additional plots and technically put the project out of prescription. With only the morning of 8 June remaining and poor weather, due to wind and the marine layer, there was insufficient time to burn the remaining SDSU plots as well as clean and return all equipment to the Federal Fire Wilson Cove Station for placement on the barge back to Naval Base San Diego. Following the slow start from weather complications, there had been little expectation that any SDSU plots would be burned within the allotted timeframe.

A detailed timeline for each day along with photos and burn plot notes can be found in Attachments 5 and 6.

4.0 "Lessons Learned"

The following is a list of lessons learned during the 4–8 June 2012 Rx Burn Project. Recommended solutions are provided.

Issue:

Due to the logistical challenges presented by a remote landscape like SCI the price per acre for an Rx Burning Project can be very expensive. SCI is not like the mainland where resources can be easily reassigned to other projects when weather conditions are unfavorable. The logistics of shipping crews, supplies, and specialized equipment to SCI is costly, especially when these resources cannot be used because of conditions that can suddenly put an Rx Burning Project out of prescription. However, this is not a reason to avoid the use of Rx Fire, rather it is factor to be taken into account when implementing research and land management practices. Fire, without consideration for frequency, has been part of the SCI ecosystem for hundreds of years.

Recommendation:

In this situation, patience must be exercised. Long range weather forecasts must be used to help pinpoint the best time of year to utilize Rx Fire. A provision for Rx Fire within the "Declared Fire Season", when some of the best burning conditions of the entire year exist, particularly during the middle of the season, would be beneficial. As managers better understand fire behavior programs and increase their experience through the relatively safe implementation of Rx Fire, the program will become more economical.

Issue:

Communication on any project is an important component of success. In a project involving fire it is critical that each person fully understand and conduct the tasks needed to fulfill their role. During the Rx Burn, instances were encountered where roles and tasks were not fully understood, resulting in: reminders to team members about their duties, the burning of a plot in a manner other than originally planned, failure to adjust a burn plan based on changing wind direction, improper engine placement that could have resulted in personal injury or property damage (Photo 16), and the firing of a plot prior to its complete treatment with Insul-8: This final issue led to the inability to use that plot for data analysis purposes, since the required suppression efforts violated the overall study design.

Photo 16. Poor engine placement put this equipment and any personnel near it in jeopardy. Thankfully, no damage occurred.

Recommendation:

Communication requires constant attention. It is important when giving instructions that the message receiver is asked to repeat back the request to ensure complete understanding. All roles and necessary tasks should be documented in the Rx Fire Plan to ensure that all aspects are fully covered. In addition, the incorporation of the Federal Fire Department's Incident Action Plan should be added to the overall initial briefing and documentation process. Once the on-site escape plan is devised, any additional tasks and responsibilities should be clearly assigned. Additional personnel to fill supporting roles covering all necessary support tasks such as water tender filling, hauling line, and fire ignitions should be included in the project plan. An additional leadership position is needed as part of the fire suppression holding team. Once activities have begun, following the communications chain of command is essential to the safe operation of this type of event. The Fire Crew Leader is in charge of the crew and issuing direct orders to firefighters should not occur by anyone else. Prior to commencing any burning activity, the Safety Officer should issue an "All Clear" signal. Finally, a daily critique of the day's events with the entire team could result in identification of communication gaps in a timely manner. During the initial stages of the Rx Burn, it may be important to perform a status assessment more frequently to ensure all roles are properly handled and that the safety of the project is maintained.

Issue:

Drip torches are customarily lit within the roadway, from where fires are normally ignited. This practice presents two potential problems when burning individual plots located away from the roadway. First, the ignited grass is held in place by a boot until the drip torch is lit (Photo 17). Once released, winds can easily carry the burning grass into non-target fuels. Second, carrying a lit drip torch through an expanse of dried grass may result in unintentional fire starting in areas that have not been treated with Insul-8.

Photo 17. A large handful of dry grass is soaked in drip torch fuel and then ignited with a lighter. A fireman's boot holds down the clump of burning dry grass. The winds were carrying embers towards the dead grass at the edge of the road.

Recommendation:

Burners were directed to ignite their torches within the Insul-8 treated burn plot, thus avoiding any unintended consequences from lighting their torches in the roadway and walking to the plot.

Issue:

The outer perimeter of each plot was sprayed for a distance of 10–15 feet from the edge of the fireline to ensure thorough coverage and to minimize the chance of fire escape.

Recommendation:

As the burn plots are inventoried to measure plant propagation and growth on each plot, we suggest monitoring the outer perimeter of each plot also to see if the PHOS-CHEK Insul-8 has any lasting positive or negative impacts on plant growth.

Issue:

Some species, such as purple needle grass, require utilization (grazing) or burning to keep the plant healthy and viable. Several plots within this study contained representatives of these species.

Recommendation:

Consideration should be given to periodically re-burning some of the plots to determine the effects of fire frequency on a variety of grass species.

5.0 Conclusions

With the exception of the wind on 6 June, and the marine layer coupled with the wind on 8 June, the project went as planned and accomplished both the primary and secondary objectives. The safely executed prescribed burns clearly highlight the value that PHOS CHEK Insul-8 brought to the completion of these 51 burn plots. Moreover, this project highlighted additional training needs to effectively use Rx Fire on SCI. Finally, the successful completion of these 51 burn plots clearly demonstrates that Rx Fire is a safe and valuable tool that can be used on SCI for consuming native and non-native vegetation, when the objectives for burning are clearly identified and the resulting prescription is designed, funded, approved and carried out to the letter by well trained and experienced personnel.

6.0 Acknowledgements

There are a number of individuals that made the success of this project possible. First and foremost we want to thank Commander Walter Glenn for his steadfast support for this project. Without the logistical support we received from Federal Fire on San Clemente Island, in particular, Battalion Chief 13 Robert Uribe and his immediate assistants and firefighters under his command, this project would not have been possible. Without the efforts of Dr. Dawn Lawson with the support of the Pacific Fleet Natural Resources Program Manager, Jacqueline Rice, this project would never have happened. Dr. Lawson persevered through many setbacks to bring the research team together to design the study, lay out the plots, and secure the funding. We are grateful to the Federal Fire Department for serving as prescription burners, and providing the containment force and logistical support in advance of the burns. We also thank Gordon Springell, the PHOS-CHEK Gel Technical Representative, who went above and beyond over a two year period in providing the spray equipment, and on-site Technical Representatives, Jeff Kinyon and Jim McCarter to operate the PHOS-CHEK pump and mix the Insul-8 gel concentrate in 2011 and 2012. Finally, thanks goes to UXO Technician, Tom Lee, who cleared all planned sites of UXO hazards over the two year period.

All photos, unless otherwise noted, were taken by Wendy Pearson (TDI).

7.0 References

U.S. Department of the Navy (DoN), Southwest Division. 2001. San Clemente Island Integrated Natural Resources Management Plan. San Diego, CA. Prepared by Tierra Data Systems, Escondido, CA.

U.S. Fish and Wildlife Service (USFWS). 1984. Recovery plan for the endangered and threatened species of the California Channel Islands. U.S. Fish and Wildlife Service, Portland, Oregon. 165 pages.

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Attachment 1: Fire History at San Clemente Island (1979–2012)

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Attachment 2: Product Description and Material Safety Datasheet for PHOS-CHEK Insul-8 Liquid Gel Concentrate

PHOS-CHEK® Insul-8

Structural Fire Protection & Suppressant Liquid Gel

Description & Use:

PHOS-CHEK is proud to offer an important new product specially designed for Municipal and Industrial Fire Departments. PHOS-CHEK Insul-8 is a highly effective Structural Fire Protection and Suppression Gel; with enhanced coverage and superior adherence qualities.

Far superior to other available gels, this unique product can be effectively applied in a coating several inches in thick on most vertical surfaces with little to no slumping. This enables fire fighters to protect buildings, tanks and other structures from flame and /or heat impingement without tying up valuable resources to continuously spray water.

PHOS-CHEK Insul-8 is also effective for direct fire suppression by inducting directly into the water stream. Insul-8 will multiply the effectiveness of the water by eliminating run-off and improving adherence to the burning fuel.

PHOS-CHEK Insul-8 is a liquid concentrate product that is added to the water at the required mixed ratio, either by eduction, liquid proportioning devices or batch mixer.

Insul-8 requires significantly less concentrate than other LC Gels to obtain the same properties. Effective mix ratios are between 0.37% and 3% depending on application.

PHOS-CHEK Insul-8 Gel is qualified by the USDA Forest Service under its new specification 5100-306A.

Product Characteristics:

Color / Odor:	Yellowish Liquid
Mix Ratio:	Direct Suppression 0.37% - 0.55% Structural Protection 1% - 3%
Specific Gravity:	0.960
Viscosity: *(Concentrate)*	800 -1200 centipoise *(cPs)*
Viscosity: *(Mixed)*	>4000 centipoise *(in Distilled Water) @ 0.6%* >8000 cPs (*in Distilled Water) @ 1.0%*

Packaging: PHOS-CHEK Insul-8 is available in 5 gallon pails *(19 litters)* and 264.4 gallon totes *(1000 litters)*

PHOS-CHEK® Fire Retardant, Class A Foam & Gel **Quality Products, Exceptional Response**

PHOS-CHEK® Insul-8

Structural Fire Protection & Suppressant Liquid Gel

Always use the right tool for the job:

Application	Long-Term Retardant	Gel	Class A Foam	Water
Indirect Attack	√√√√	√√	√	
Direct / Parallel Attack	√√√√	√√√	√√	√
Interior Structure Attack		√√	√√√√	√
Structure Protection-Indirect Application	√√√√	√√√	√√	√
Structure Protection-Direct Application		√√√√	√	√
Mop Up	√√√√	√√√	√√√√	√
Prescribed Burn Control	√√√√	√√√	√√	√

√√√√ = Superior Effectiveness √√√ = Excellent Effectiveness √√ = Good Effectiveness √ = Baseline Effectiveness

FOR DETAILED SAFETY INFORMATION PLEASE REFER TO THE MSDS.

ICL Performance Products LP
www.phoschek.com

For more information, contact any of our worldwide wildfire offices or visit us as www.phoschek.com:

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RESPONSIBLE CARE® OUR COMMITMENT TO SUSTAINABILITY

ICL Performance Products LP

Material Safety Data Sheet

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Identification

Product Name: Phos-Chek ® Insul-8
Reference Number: AST10155
Date: May 23, 2011

Use of the ingredient or preparation

Fire Suppressant Gel

Company information

ICL PERFORMANCE PRODUCTS LP
622 Emerson Road - Suite 500
St. Louis, Missouri 63141

Emergency telephone: In USA call CHEMTREC: 1 800 424 9300

Outside the USA, including ships at sea, call CHEMTREC's international and maritime telephone number (collect calls accepted): +1 (703) 527-3887

In Canada call CANUTEC: 1 613 996 6666

General Information: +1 800 244 6169 (Worldwide)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Composition

Substance	CAS No.	EINECS No.	% v/v	Risk Phrases
Triethanolamine	102-71-6	203-049-8	10-30	None

Components are Company Trade Secret – Business Confidential. ICL Performance Products LP is withholding the specific chemical identity under provision of the OSHA Hazard Communication Rule Trade Secrets (1910.1200(i)(1)). The specific chemical identity will be made available to health professionals in accordance with 29 CFR 1910.1200(i)(1)(2)(3)(4).

3. HAZARDS IDENTIFICATION

Classification of the substance/preparation

EC Classification None
Safety Phrase None

Human Health Effects

Mildly irritating to eyes. Slightly irritating to skin.

Environmental Effects

This material is not expected to produce any adverse environmental effect when recommended use instructions are followed.

4. FIRST AID MEASURES

General

Likely Routes of Exposure: eye and skin contact, ingestion.

Eye Contact

Flush eyes with water for at least 15 minutes while holding eyelids open. Seek immediate medical attention if irritation persists.

Skin contact

Flush with copious amounts of water for at least 15 minutes. Get medical attention if irritation persists. Remove contaminated clothing and launder before reuse.

Inhalation

Remove person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, get immediate medical attention.

Ingestion

If conscious, wash out mouth with water. Do NOT induce vomiting. Never give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs.

5. FIRE FIGHTING MEASURES

This section applies to fires involving the concentrate rather than its diluted solutions.

Flash Point: >177 °F TCC
Fire Point: >199 °F TCC

Extinguishing media

Water spray, foam, dry chemical, and carbon dioxide.

Unsuitable extinguishable media

Not determined

Exposure hazards

Water will cause extreme slipperiness.

Protective equipment

Self contained respirators required for firefighting personnel.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Avoid unnecessary exposure and remove all material from eyes, skin, and clothing.

Environmental precautions

Small quantities: See below.
Large quantities: See below.

Method for cleaning up

For small spills, soak up with absorbent material. For large spills, dike to contain spill to prevent water pollution. Recover diked material.

Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Handling:

Handle in accordance with good industrial hygiene and safety practices.

Engineering measures

Provide natural or mechanical ventilation to minimize exposure in enclosed environments. The use of local mechanical exhaust ventilation is preferred at sources of air contamination such as open process equipment. Consult National Fire Protection Association (NFPA) Standard 91 for design of exhaust systems.

Storage

Product is stable under normal conditions of storage and handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure limit

OSHA and ACGIH have not established specific exposure limits for this material.

Components referred to herein may be regulated by specific Canadian provincial legislation. Please refer to exposure limits legislated for the province in which the substance will be used.

Respiratory protection

As a general precaution, avoid breathing vapor and /or mist. No special respiratory protection required. Use NIOSH/MSHA approved respiratory protection equipment when airborne exposure is excessive. Consult the respirator manufacturer to determine appropriate type equipment for a given application. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer. Refer to OSHA 29 CFR 1910.133 or European Standard EN 149.

Hand/Skin protection

Chemical resistant protective gloves and closed work clothing is recommended. Wash soiled clothing.

Eye protection

Wear appropriate protective eyeglasses or chemical safety goggles as described in OSHA 29 CFR 1910.133 or European Standard EN166.

9. PHYSICAL AND CHEMICAL PROPERTIES

General information

Appearance:	Creamy yellowish liquid
Odor:	Slight oily odor

Important health, safety and environmental information

Viscosity:	800 - 1200 cps
Specific Gravity:	0.960
Solubility in Water:	Insoluble, will absorb water

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Conditions to avoid

Product is stable under normal conditions of storage and handling.

Materials to avoid

Oxidizing agents

Hazardous decomposition

Nitrogen Oxides, Carbon Oxides

11. TOXICOLOGICAL INFORMATION

Laboratory Data

Data from ICL Performance Products LP single-dose (acute) animal studies with this material are given below:

Oral - rat LD_{50}: > 5,050 mg/kg; practically nontoxic
Dermal - rabbit LD_{50}: > 2020 mg/kg; no more than slightly toxic
Eye Irritation - rabbit: 6.0/110.0; mildly irritating Single wash eyes
Eye Irritation - rabbit: 6.0/110.0; minimally irritating Double washed eyes
Skin Irritation - rabbit: 0.9/8.0 (24-hr exp.); slightly irritating

This material has been defined as a hazardous chemical under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

12. ECOLOGICAL INFORMATION

Environmental toxicity

The following data have been classified using the criteria adopted by the European Economic Community (EEC) for aquatic organism toxicity.

96-hr LC_{50} Rainbow trout: 1051 mg/l, Practically Nontoxic

Environmental Fate

Considered non-biodegradable per U.S. Forest Service Specification 5100.306a, OECD 301B, and OPPTS 835.3110(m). The product was found to be 56% biodegraded in 42 days.

13. DISPOSAL CONSIDERATIONS

European waste catalog number

Undetermined.

Disposal Considerations

This material when discarded is not a hazardous waste as that term is defined by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261. Consult your attorney or appropriate regulatory officials for information on such disposal.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

Road/Rail, Sea and Air

IMDG/UN - Not regulated for transportation
ICAO/IATA - Not regulated for transportation
RID/ADR - Not regulated for transportation
Canadian TDG - Not regulated for transportation
US DOT - Not regulated for transportation

15. REGULATORY INFORMATION

EC Label

None

Chemical Inventory

USA TSCA: Listed
Canadian DSL: Listed

WHMIS Classification: D2(B) - Materials Causing Other Toxic Effects

SARA Hazard Notification
Hazard Categories Under Title III Rules (40 CFR 370): Immediate
Section 302 Extremely Hazardous Substances: Not Applicable
Section 313 Toxic Chemical(s): Not Applicable

CERCLA Reportable Quantity: Not Applicable

California Prop. 65: This product contains a component (< 1.0 %) that may contain residual (<100 ppm) concentrations of propylene oxide (CAS# 75-56-9).

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulation and the MSDS contains all the information required by the Canadian Controlled Products Regulation.

Refer to Section 11 for OSHA Hazardous Chemical(s) and Section 13 for RCRA classification.

16. OTHER INFORMATION

	Health	Fire	Reactivity	
Suggested NFPA Rating	1	0	0	
Suggested HMIS Rating	1	0	0	B B = Safety glasses, gloves

ICL Performance Products LP Material Safety Data Sheet
Material: Phos-Chek ® Insul-8 Page 6 of 6
Reference No.: AST10155 May 23, 2011

Reason for revision: Revised sections 1, 2, 3, 7, 11, & 12.
Supersedes MSDS dated: March 10, 2009
Drafted in accordance with ECC Dir 2001/58/EC

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, ICL Performance Products LP makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will ICL Performance Products LP be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS

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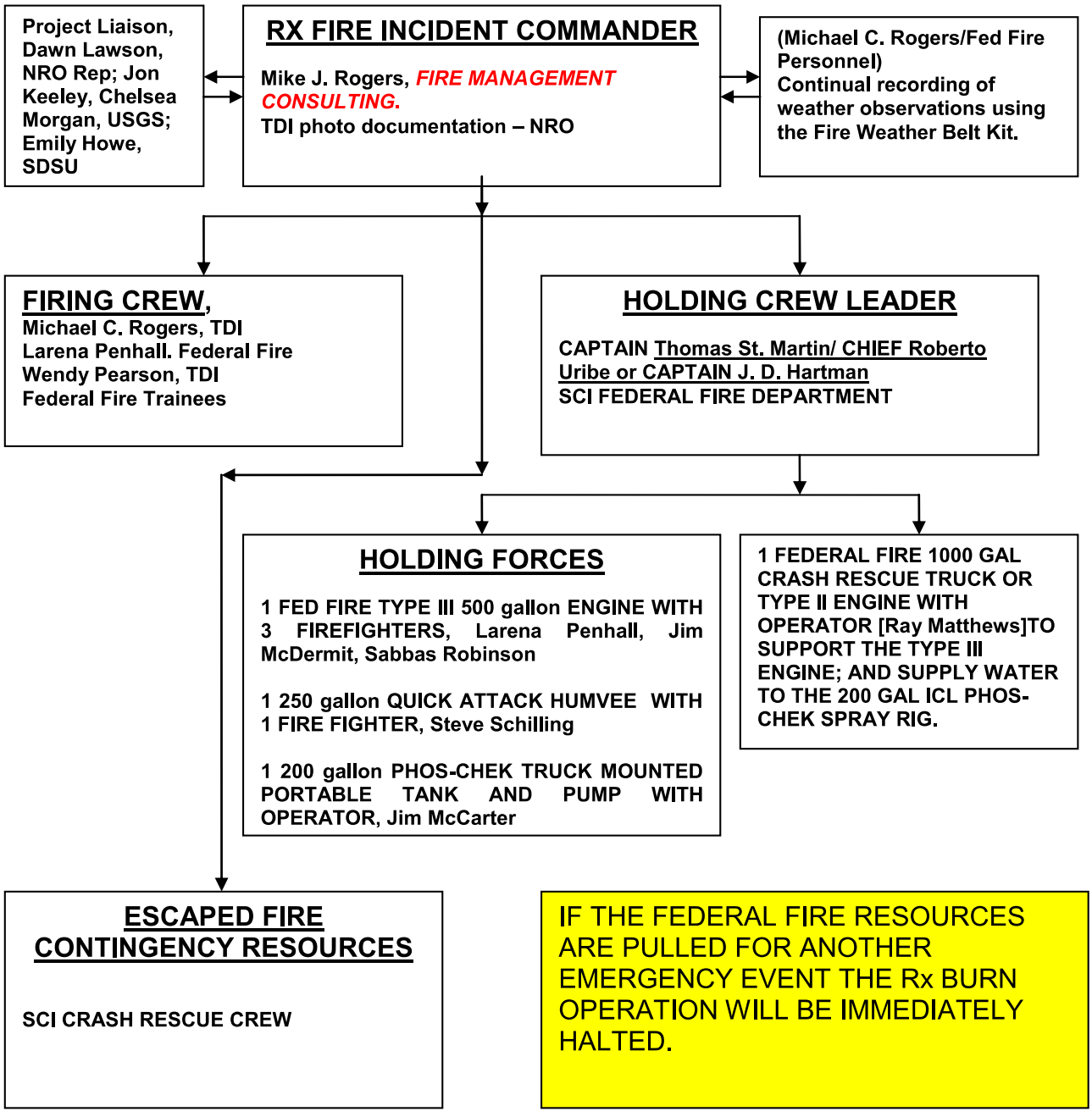
Attachment 3: Updated Prescribed Fire Organization Chart and Assignments



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Attachment 4: Updated Prescribed Fire Communications Plan

2012 Rx FIRE
COMMUNICATION PLAN

Federal Fire will provide 6 Federal Fire Department radios that are on the new ELMR's net. One Fed Fire radio will be assigned to each individual.
The following call designations are assigned:

Les Stone	**7-Sierra**
Abel Holquin	**6-Alpha**
Jim McKenzie	**6-Quebec**
Tom Lee	**6-India**
Emily Howe	**Botany 1**
Mike J. Rogers, Project Coordinator,	**Firewise 1**
FIRE BEHAVIOR OFFICER, Michael C. Rogers,	**Firewise 2**
Photographic Documentation: Wendy Pearson	**Tierra Data 1**
Wendy Pearson, Michael C. Rogers, Lighter	**Tierra Data 1 / Firewise 2**
Jim McCarter, ICL Performance Products	**PHOS-CHEK 1**
Dawn Lawson, Project Manager	**NRO 1**
Chelsea Morgan, USGS Technician	**USGS 1**

(Battalion 3 will be the contact for all Fed Fire Holding Resources including the Type III Engine and crew, Rescue Truck and crew, the quick attack HUMVEE and medical unit)

On the day of the burn all personnel will assemble at the Fed Fire Airport Station). A communications check will be made to insure all personnel will have working radios. We will conduct a separate communications check from the plot sites at 0700 hours to insure all units and locations have contact. We will utilize the following frequencies:

Fed Fire ELMR's net: Channel 1, Trunk A
(The following personnel will have a FED FIRE ELMR's radio:, Battalion 3, Michael C. Rogers-Fire Behavior Officer, Wendy Pearson, ICL Operator, Jim McCarter, Dawn Lawson, NRO Project Manager and Mike Rogers-Incident Commander).

All radio batteries must be changed out during the day to maintain communication. All radio batteries must be recharged each night for the next day's operation.

Michael J. Rogers
2012 SCI Project Coordinator for TDI

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Attachment 5: Prescribed Fire Project Chronology

Day 1, Monday, June 4, 2012

After arriving on the island, we went to Public Works to check out our two vehicles. Then we drove to the Wilson Cove Fire House to retrieve our supplies and the ICL PHOS-CHEK pump. We went to the Commons for a 1030 hours briefing on the prescription with Commander Glenn and a UXO briefing by UXO Technician Tom Lee. We were issued our radios and a Nextel phone. We returned to the Airport Crash House to start the pump and to mix the first 200 gallons of PHOS-CHEK Insul-8 gel. The pump would not start, due to rain water getting into the combustion chamber of the pump engine. After taking the engine apart, the pump finally started and we mixed the first load of gel. At 1400 hours we left for the Windmill site with a Fed Fire Type III Engine, a quick attack Humvee and three Fed Fire Firefighters to look at the site and take weather observations. The site was too windy; and therefore, out of prescription. We laid out several hundred feet of hose as a drill and practiced spraying/applying 200 gallons of PHOS-CHEK Insul-8 gel to work out any bugs.

Day 2, Tuesday, June 5, 2012

0700 hours: Placed revised pages with updated personnel data in the approved Rx Fire Plan. Mixed a new 200 gallon load of PHOS-CHEK Insul-8 gel and checked radios to ensure we were all on the same frequency at the Airport Crash House. We left the Crash House at 0845 hours for the plots on Horton Road.

0915 hours: Arrived at the Horton Road east perennial grassland (PGE) plots (Map 1) where we took weather and handed out copies of the approved Prescription and Plan. We did a comprehensive briefing, including review of the escape plan, assignment of personnel to an escape vehicle, and a test run of going to the assigned vehicles. Wind conditions were well beyond the cut off value until 1035 hours.

1042 hours: weather; dry bulb, 68; wet bulb, 57; RH, 52%; wind speed, 0-3 miles per hour (mph); direction, from the northwest; fuel moisture, 7; we are in prescription.

We weed whacked a 2-foot wide control line around the three test plots, noting that our boots were getting wet from walking through the tall grass. We then sprayed the outer perimeter of the weed whacked fireline on the east and north sides and sprayed the thick ground litter on the weed whacked fire lines. The smoldering fire in the first Test Plot Burn slowly crept in a westerly direction, under the weed whacked and Insul-8 sprayed fireline, beneath the heavy ground litter, and ignited the adjacent plot (Photo 1 and 2). Test Burn 1 was a hot running fire that completely consumed all standing vegetation. Test Burn 2, an unintentional burn, was a backing fire that left a lot of unconsumed grasses lying in the burned area.

Map 1. The Perennial Grass East (PGE) Plots 1-10 on Horton Road.

Photo 1 and 2: The first test burn went through the Insul-8 treated fireline, where it had not been applied heavily enough for the amount of ground litter remaining (yellow lines denote plot boundaries). Photo 2 shows a close-up of the smoldering ground fire burning beneath the treated perimeter.

The results of the first Test Burn indicated to all personnel the need to thoroughly soak the ground litter lying in the weed whacked firelines and clearly demonstrated why we needed more than just the weed whacked fire lines around each grass plot. Even though we were burning under a prescription, without the Insul-8 we would have had escapes into the adjacent dry grass and would have been chasing wildfires.

As it was the PHOS-CHEK Insul-8 gave us a distinct advantage by rendering the adjacent fuels unavailable to ignition sources (brands, embers, radiant heat, spilled drip torch fuel, etc.). PHOS-CHEK Insul-8 is a very effective fire retardant gel concentrate that is mixed at the rate of one gallon of Insul-8 concentrate to 100 gallons of water.

1111 hours: Test Plot 3 was laid out with flagging well within the interior of a weed whacked square. Once Test Plots 1 and 2 were extinguished, wind conditions were out of prescription at 8 mph with gusts up to 12 mph.

1314 hours: The winds finally diminished allowing us to proceed with Test Burn 3 inside a flagged circle. After the wind subsided, the outer perimeter was sprayed with an application of PHOS-CHEK Insul-8 gel. The interior of the flagged circle was ignited; with the resulting fire spreading very rapidly to the flagged perimeter, where it went out once it reached the area treated with Insul-8 (Photo 3-5).

Photos 3-5: A circle of flagging was laid out and the outer perimeter was sprayed by Insul-8. The interior of the flagged circle was ignited and the resulting fire ran to the edge of the flagging and went out; a graphic example of how Insul-8 works.

1346 hours: Weather was taken before proceeding with the spraying treatment and burning of PGE Plot 10 (wet bulb, 55; dry bulb, 56; RH, 54; wind, NW; wind speed, 4 mph; fuel moisture, 7; which was in prescription). Prior to burning any plots and after each plot was extinguished, a biologist checked each plot and adjacent area for nesting birds. No nests were found on any of the Horton Road plots.

The plot was sprayed and then strip burned [1354 hours] by first burning in a black line on the windward edge of the plot, and then backing up and running fire into the blackened strip (Photo 6). The burn was “text book” perfect.

We started spraying PGE Plot 9 and the winds again picked up, reaching speeds of up to 12 mph. We secured the site and again waited for the winds to subside, while intermittently taking weather readings.

1630 hours: The winds did not let up. The Project Coordinator, after conferring with the Project Manager, decided to call it a day. The winds finally subsided at 0400 the next day (6 June).

Photo 6: PGE Plot 10, the first of 20 plots burned on Horton Road.

Day 3, Wednesday, June 6, 2012

0700 hours: After breakfast, we headed back out to the Horton Road plots (Map 2). We rebriefed all participants on the Burn Plan and were ready to go but are not on the schedule to begin burning until 0800 hours. Weather was taken and was well within the prescription; sprayed the perimeter of the Test Burn and PGE Plot 9.

0800 hours: Called Range Control and informed them we were ready to ignite our first Test Plot for the day (Photo 7). There was some moisture on the grass, which indicates we need to put more fire into each plot to achieve the kind of burn the Project Manager wants. The test plot burned well.

0810 hours: PGE Plot 9 was center fired and then the edges ignited, which ran towards the center fire (Photo 8). The plot burned very quickly and consumed all vegetation on the plot.

Photo 7 and 8: The Test Burn for 6 June (left) is ignited at 0800 hours by perimeter firing the edges, starting from the edge the wind is blowing towards. There is very little wind. PGE Plot 9 (right) was center fired, burning very quickly with no wind.

0823 hours: PGE Plot 8 was center fired and burned out very quickly (Photo 9).

0841 hours: PGE Plot 7 was strip burned as the wind began to pick up slightly (Photo 10).


Photo 9 and 10: PGE Plot 8 (left) is center fired and then the perimeter is ignited to run towards the center of the plot. PGE Plot 7 (right) is strip fired along the windward edge. The burners then drop back and run another strip burn into the blackened area and continue doing this until they reach the back of the plot.

0856 hours: PGE Plot 6 was a perimeter burn, starting from the southwest corner and burning around the edges (Photo 11).

0904 hours: PGE Plot 5 was burned, using the same perimeter technique used on PGE Plot 6 (Photo 12).


Photo 11 and 12: PGE Plot 6 (left) and Plot 5 (right) are perimeter fired starting along the southwest corner and working back around the edges. Both burners are taking a lot of heat as the day warms up and the fires are burning hotter.

0917 hours: PGE Plot 4 was strip fired from the southwest corner with the burners working back and strip firing towards the southwest corner (Photo 13).

0925 hours: PGE Plot 3 experienced 4-foot flame heights. Ignition was again at the southwest corner, and then the remainder of the plot was strip fired back towards the southwest corner (Photo 14).


Photo 13 and 14: PGE Plot 4 (left) is perimeter fired starting along the southwest corner and then strip firing back towards the southwest corner. PGE Plot 3 (right) is perimeter fired starting along the southwest corner. The burn is exhibiting 4-6 foot flame heights and producing a lot of heat.

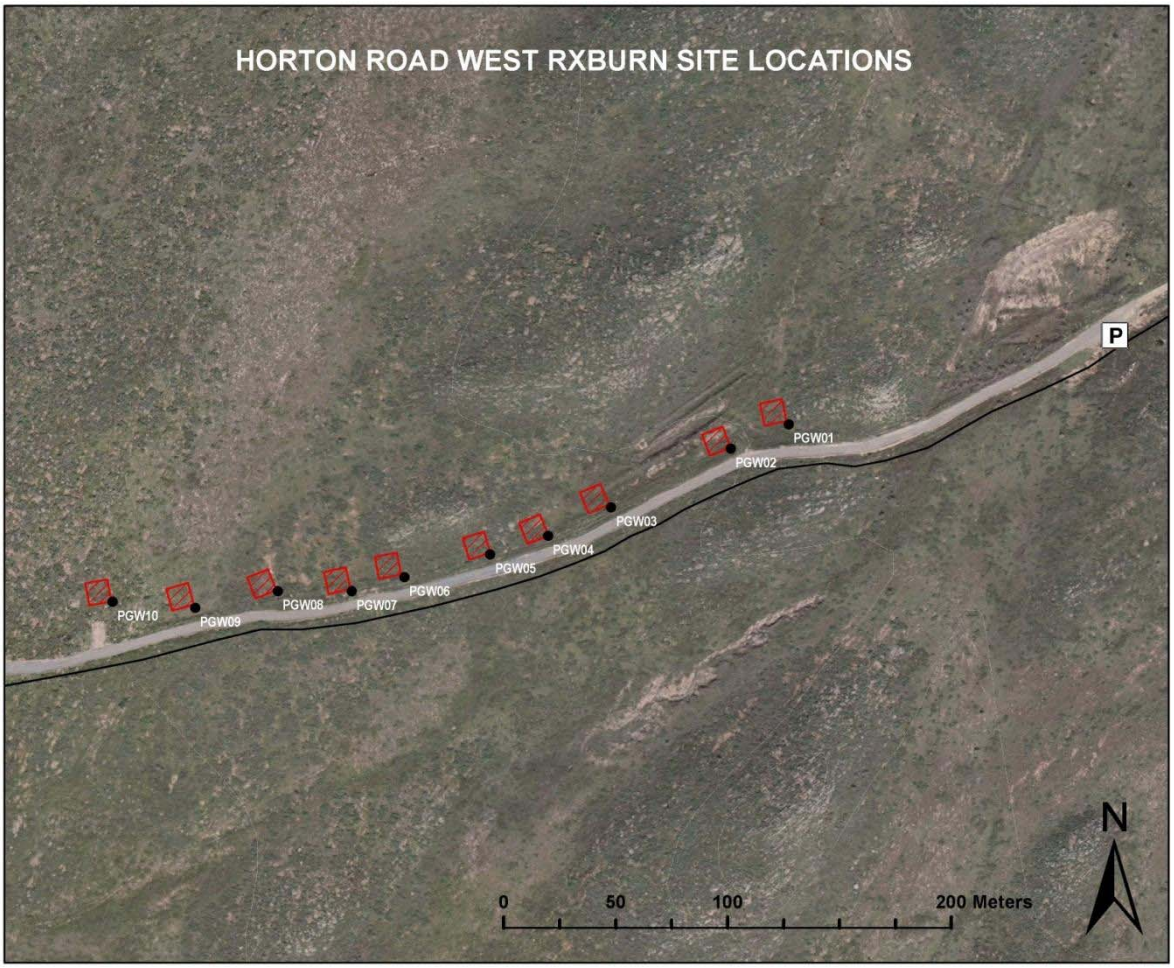
0944 hours: The wind very slightly picked up out of the northeast. PGE Plot 2 was fired from the southwest corner and then perimeter fired after developing a good black line (Photo 15).

1000 hours: The wind is from the northeast at 2-4 mph. PGE Plot 1 was fired from the southwest corner and once a black line was burned in, it was then perimeter fired back towards the starting corner (Photo 16).


Photo 15 and 16: PGE Plot 2 (left) is perimeter fired starting along the southwest corner. The burn is exhibiting 4-6 foot flame heights and producing a lot of heat. PGE Plot 1 (right) is perimeter fired starting along the southwest corner. Notes and measurements are taken throughout the process. The wind is steady from the northeast at 2-4 mph.

1017 hours: Started on the Horton Road west perennial grass (PGW) plots (Map 2). Wind occasionally picked up with gusts to 7 mph, but steadied at 2-4 mph. The plots are beginning to contain morning glory. PGW Plot 1 was strip fired, starting from the southwest corner with one burner and worked back towards the wind to increase the amount of black line (Photo 17). As the day continued, the temperature was rising and humidity dropping, with hotter burns.

1113 hours: Took weather observations. The wind had occasionally been gusting to 8 mph. Each plot was taking about two minutes to completely burn out. PGW Plot 2 was originally planned to be strip fired, but a miscommunication resulted in perimeter firing of this plot (Photo 18). Due to the higher wind conditions, strip firing of this plot would have been a safer approach and would have resulted in less fuel engulfed in fire at any one point in time.



Map 2. The Perennial Grass West Plots 1-10 on Horton Road.

Photo 17 and 18: The PGW Plot 1 (left) burn is started at the southwest corner and then strip fired back towards the starting corner. The PGW Plot 2 (right) burn was started at the southwest corner and perimeter fired, resulting in a lot of fire running back towards the southwest corner; the Insul-8 holds.

1127 hours: PGW Plot 3 was strip burned starting at the southwest corner using one lighter (Photo 19). The winds are again periodically gusting to 7 mph. A patrol was sent back to check all previous plots for smokes that may have been kicked up by the wind.

1151 hours: PGW Plot 4 was burned very slowly and deliberately (Photo 20). The wind was still out of the northeast but with gusts up to 7 mph once burning was initiated. This plot was also started with a strip burn from the southwest corner. PGW Plot 4 was completed at 1158 hours, taking 14 minutes.


Photo 19 and 20: PGW Plot 3 (left) is ignited at the southwest corner and is strip fired towards the southwest corner while the next plot is prepared with Insul-8 in the background. PGW Plot 4 (right) is strip fired beginning in the southwest corner and then additional strips were ignited.

1208 hours: PGW Plot 5 has a lot of morning glory within the plot (Photo 21). The wind switched around during the actual burn from northeast to northwest. Strip burning was used, due to unexpected wind gusts up to 7 mph. This plot took six minutes to burn because of the wind gusts; we just needed to take it a bite at a time and let the fire burn out before starting the next strip.

1228 hours: The wind was changing direction, again coming out of the northeast at 3-4 mph with gusts to 7 mph. The change in wind direction was not accounted for in the burning of PGW Plot 6 (Photo 22). For safety, fire should be set so that the wind is blowing the flames into the already burned area. In this instance, the fire was ignited so that the fire was blowing into unburned vegetation within the plot. In all plot burns the Insul-8 gel/water mix kept adjacent highly flammable fuels from igniting.


Photo 21 and 22: PGW Plot 5 (left) was started at the southwest corner and slowly strip burned back into the black line. The wind was switching from NE to NW. PGW Plot 6 (right) was started at the southwest corner. However, the wind had shifted and the fire had not been set from the windward edge, which allows the fire to run with the wind toward unburned vegetation in the plot. Suppression action was required to extinguish smokes outside the weed whacked fireline.

1240 hours: Smoldering smokes had popped up on PGW Plots 2 and 3 due to the warming of the day and an increase in wind speed. Smoldering fires were working under the weed whacked firelines toward the unburned vegetation on the outer

perimeter. The winds were such that we were out of prescription and all ignitions were curtailed.

1417 hours: The wind dropped back to a steady 4 mph and we were back in prescription; however, the wind was directly out of the west. PGW Plot 7 was ignited along the eastern edge of the plot and then strip burned by running fire into the black line (Photo 23).

1440 hours: The burning of PGW Plot 8 was aided by a steady 4 mph wind out of the west. The fuels on PGW Plot 8 were very light. The plot was burned by creating a black line along the eastern edge of the plot and then strip firing into the black line (Photo 24).

Photo 23 and 24: PGW Plot 7 (left) and Plot 8 (right) were started along the eastern edge and strip burned.

1509 hours: We were experiencing a west wind right at the top of the permissible wind speed chart. PGW Plot 9 was ignited along the east edge and worked west (Photo 25). It took seven minutes to carefully burn this plot. A dying island night lizard was discovered at the edge of the plot.

1538 hours: PGW Plot 10, the last of the Horton Road plots, was strip burned (Photo 26). This plot had very low growing herbaceous vegetation.

Photo 25 and 26: PGW Plot 9 (left) and Plot 10 (right) were strip burned beginning along the eastern edge due to winds from the west.

1600 hours: We secured the Horton Road site, leaving Brush 112 behind to check the plots and moved to the Windmill (WM) site; however, the winds exceeded the prescription. We made the decision to head back to the Crash House and get ready for the next day. Arrangements were made with Range Control to get on the schedule at 0700 hours.

Day 4, Thursday, June 7, 2012

0630 hours: Drove to the WM site (Map 3) and began preparations, including positioning the vehicles as part of the escape plan.

Map 3. Grass Plots 1-15 at the Windmill Site.

0745 hours: Prepared test plot on the south side of Windmill Road (Photos 27-30) and took weather observations. We were at the lower end of the prescription. We notified Range Control we were ready to ignite the Test Burn. It was ignited at 0756 hours and burned well.

Photos 27-30: Test Burn at the Windmill site is laid out, weed whacked, sprayed with Insul-8 and ignited.

0810 hours: WM Plot 15 was center fired followed by ignition of the perimeter (Photo 31). The plot had very patchy grass and patches of very short boxthorn and old, fine thatch. The plot was very difficult to burn and the burn is very patchy.

0828 hours: WM Plot 14 was burned with little wind resulting in another patchy burn (Photo 32).

Photo 31 and 32: There was little wind and the burn was very patchy on WM 15 (left). WM Plot 14 (right). Note very little wind and a patchy burn.

0837 hours: WM Plot 13 was burned (Photo 33). This plot had a little more fuel and patches of taller and thicker boxthorn. The plot was again center fired followed by ignition of the edges.

0846 hours: WM Plot 12 was burned (Photo 34). A lot of drip torch fuel was needed to get the plot to burn because of the patchiness of the vegetation.

Photo 33 and 34: WM Plot 13 (left) center fired, resulting in the edges being pulled in by the fire started in the center. WM Plot 12 (right) strip burned starting at the west edge; wind was beginning to blow towards and working back towards the east side of the plot.

0856 hours: WM Plot 1 was perimeter fired (Photo 35). The plots were starting to burn a little better, due to a longer exposure to the sun. There was still no wind.

0905 hours: WM Plot 11 (Photo 36) and then WM Plot 3 (Photo 37) were perimeter fired. WM Plot 3 had a lot of bare ground throughout.

0922 hours: WM Plot 9 was perimeter fired (Photo 38). There was some bare ground, but with more grasses and boxthorn. Six minutes later, WM Plot 5 was perimeter fired (Photo 39). WM Plot 5 had very light, mostly sparse grass fuel.

Photo 35: WM Plot 1 is perimeter fired.

Photo 36 and 37: WM Plot 11 (left) and Plot 3 (right, photo by Michael J. Rogers, 2012) are perimeter fired. The fuels are very light, but still burn well in the absence of wind.

Photo 38 and 39: WM Plot 9 (left, photo by Michael J. Rogers, 2012) and WM Plot 5 (right) were perimeter fired.

0935 hours: WM Plot 7 was perimeter fired (Photo 40). There was a lot more boxthorn on this plot.

0944 hours: WM Plot 6 was perimeter fired (Photo 41). There was a lot of bare ground and scattered grasses, but as the day goes on, even sparse plots are burning better.

0948 hours: WM Plot 8 (Photo 42) and then WM Plot 4 (Photo 43) were perimeter fired. WM Plot 4 was initially fired from the corner. Both of these plots had scattered short grasses and heavy patches of boxthorn. There was a slight wind from the east.


Photo 40 and 41: WM Plot 7 (left) and Plot 6 (right) were perimeter fired.

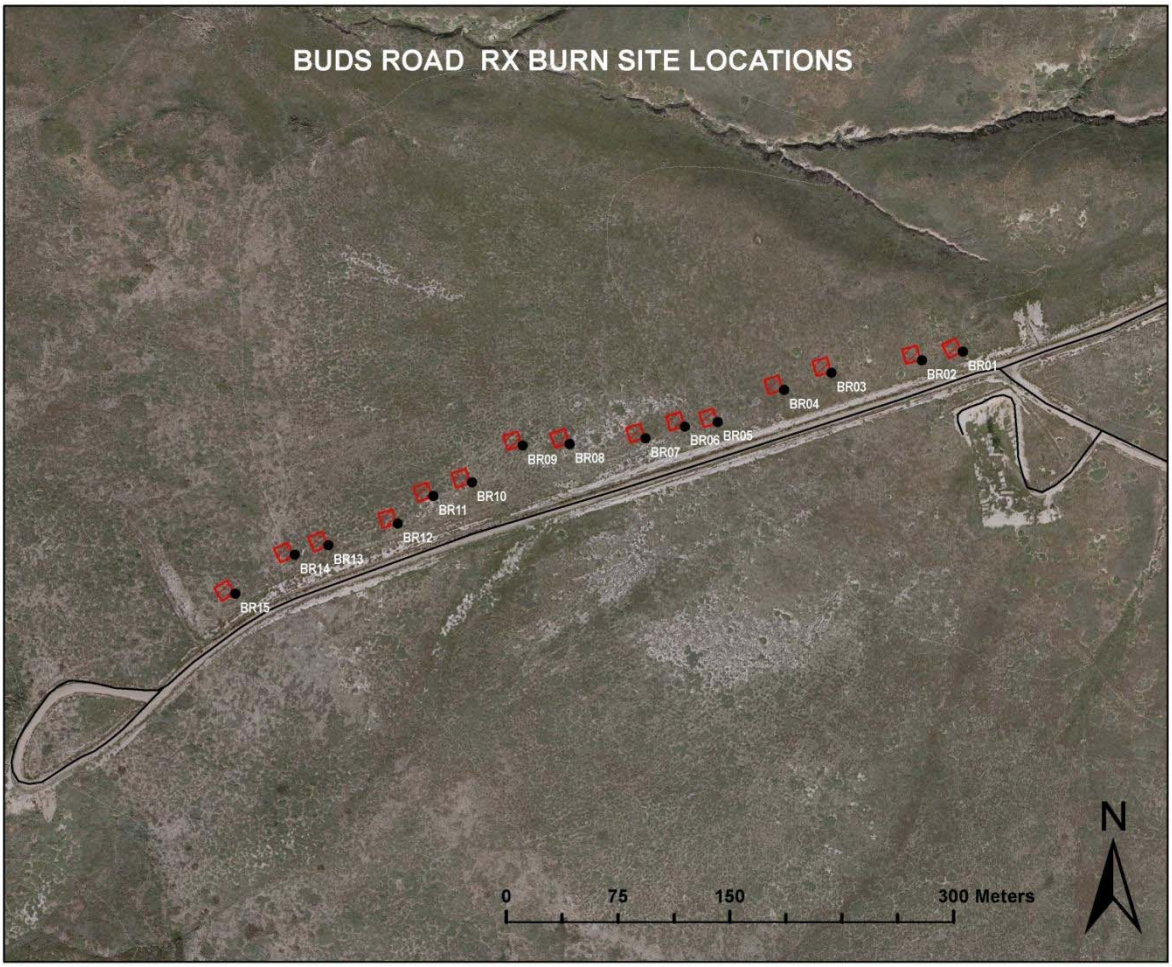

Photo 42 and 43: WM Plot 8 (left) and Plot 4 (right) were perimeter fired.

1001 hours: WM Plot 10 (Photo 44) and WM Plot 2 (Photo 45) were perimeter fired. The plots had very light fuel loads; the wind was shifting, coming from the southeast. WM Plot 2 was the last of the USGS plots at this site.


Photo 44 and 45: WM Plot 10 (left) and WM Plot 2 (right) were perimeter fired.

1015 hours: We waited for the plots to finish burning out and left Brush 112 behind until all smokes subside. We rolled up all of the hose and prepared to move the burning operation over to the Buds Road (BR) site. We notified Range Control we had completed all of the WM plots.

1045 hours: We drove to the BR plots (Map 4) and sequenced the vehicles so they are staged to keep the burned plots behind us, so as not to interfere with an escape if needed. We did another project briefing (Photo 46) before we ignited the Test Burn to make sure everyone understood their assignments and all of our radios were functioning. Range Control was notified we were ready to proceed with the Buds Road Test Burn.



Map 4. The Perennial Grass West Plots 1-10 on Horton Road.

1100 hours: We contacted and notified Range Control we were initiating the Buds Road Test Burn on the east side of Buds Road after preparing a test plot. The Test Burn went as anticipated (Photo 47).

Photo 46 and 47: Briefing prior to igniting the Test Burn at the Buds Road plots (left). Ignition of the Test Burn at Buds Road (right).

1109 hours: The Project Coordinator contacted Range Control and notified them that the Test Burn went as planned. Burning of the BR plots was initiated with the burning of BR Plot 15 (Photo 48). The fuels were very light, consisting of annual oats and bare ground stubble.

1122 hours: BR Plot 14 had a heavy fuel load of boxthorn, which produced a lot of heat. The plot was perimeter fired and exhibited good flame lengths (Photo 49).


Photo 48 and 49: BR Plot 15 (left) was ignited (photo by Michael J. Rogers, 2012). BR Plot 14 (right) was ignited.

1132 hours: BR Plot 13 had a very light fuel loading (Photo 50). The wind had picked up at a steady 4 mph out of the southeast. The Project Coordinator radioed Botany 1 and notified Emily Howe that we would be out on the Dump Road plots at about 1400 hours.

1146 hours: BR Plot 12 was center fired and then the perimeter was ignited (Photo 51). The fire on the edges was pulled into the center of the plot by the pull of oxygen from the center fire. The fuels were somewhat continuous, but very short in height. There was no wind.


Photo 50 and 51: BR Plot 13 (left) was ignited at the western edge to create a blackened line and then perimeter fired. BR Plot 12 (right) was center fired and then the edges were ignited.

1157 hours: BR Plot 11 had a lot of boxthorn and open ground (Photo 52). The fuels were getting drier as the day continued to warm. The plot burns very hot. The wind remained calm and variable in direction with wind speeds of up to 3 mph.

1210 hours: We all stopped for a lunch break as we had been going since 0630 hours.

1233 hours: BR Plot 10 was sprayed and ignited (Photo 53). The vegetation was not continuous and had patches of open ground, punctuated by large patches of boxthorn. The plot burned very hot. There was a slight wind from the southwest. TDI Staff Biologist noticed bird activity to the east of the plot and investigated the area. She quickly located a horned lark nest with two eggs in a Russian thistle (*Salsola tragus*) (Photo 54). The nest was flagged until we left the area and then the flagging was removed. We instructed the hose crews to carefully watch where they were walking and

where they were dragging hoses. Additional activity off of BR Plot 8 was noted, and a second horned lark nest was located (Photo 55) in saltbush (*Atriplex* spp.).


Photo 52 and 53: BR Plot 11 (left) and BR Plot 10 (right) were center fired and then the edges were ignited.


Photo 54 and 55: Two horned lark nests were found near BR Plot 10 (left) and Plot 8 (right). The nests were temporarily flagged so that the nearby areas were avoided by the crew.

1246 hours: There was a lot of boxthorn on BR Plot 9, although the vegetation was not continuous. The plot was center fired (Photo 56). The wind was now constantly changing direction but remaining between 3 and 4 mph.

1302 hours: There was a lot of boxthorn on BR Plot 8 (Photo 57) and the vegetation was more continuous. The BR plots were all drying out from any traces of moisture that blanketed the lower elevations the previous evening and were burning very hot. BR Plot 8 burned out in four minutes (temperature, 70 degrees Fahrenheit; relative humidity, 61; fuel moisture, 8).


Photo 56 and 57: BR Plot 9 (left) and Plot 8 (right) were center fired and then the edges were ignited.

1308 hours: There were very light fuels on BR Plot 7 (Photo 58), which were consumed within 2 minutes.

1316 hours: There was very light fuel on BR Plot 6 with a huge interior patch of box thorn (Photo 59). There was a slight wind from the southwest.

Photo 58 and 59: BR Plot 7 (left) and Plot 6 (right) have very light fuels, except for a large patch of boxthorn in the center of Plot 6.

1321 hours: There was very light fuel on BR Plot 5 (Photo 60). The wind continued to come out of the southwest. The plot burned very quickly by first burning in a blackline on the north edge of BR Plot 5 and then strip burning into the blackline.

1329 hours: There was very light fuel on BR Plot 4 (Photo 61). The wind continued to come out of the southwest. This plot burned very quickly. The plot was ignited by first burning in a black line on the north edge and then perimeter firing into the black line.

Photo 60 and 61: BR Plot 5 (left) and Plot 4 (right).

1336 hours: There was very light fuel on BR Plot 3 (Photo 62). The wind continued to come out of the southwest. This plot burned very quickly. The plot was center fired and then burned out from the plot perimeter.

1345 hours: Fuel was very light on BR Plot 2, consisting of tall oat grass and Russian thistle (Photo 63). The wind continued to come out of the southwest. This plot burned very quickly. A black line was burned in along the north edge of BR Plot 2 and then perimeter fired into the blackline.

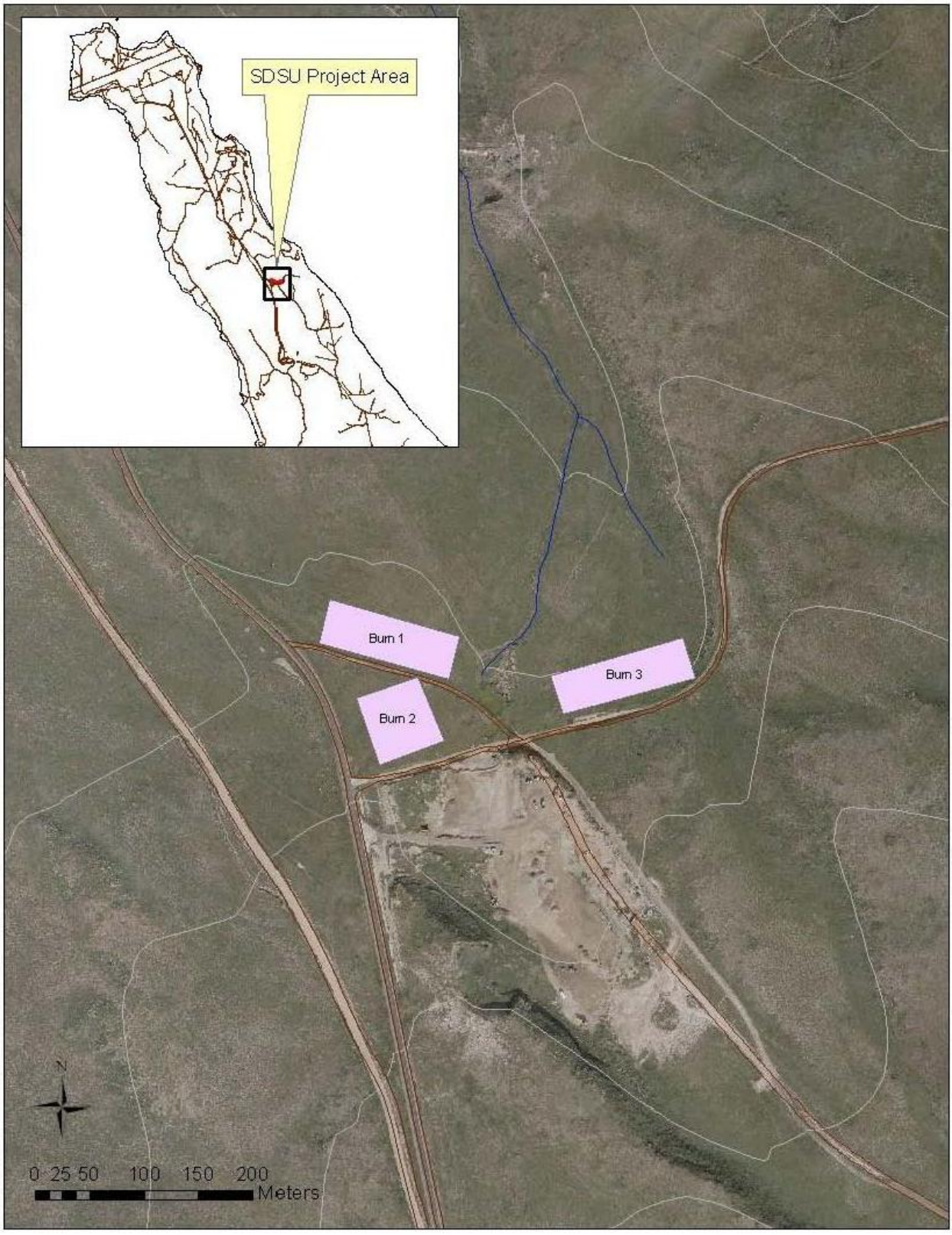

Photo 62 and 63: BR Plot 3 (left) and Plot 2 (right).

1349 hours: Fuels were very light on BR Plot 1 (Photo 64), consisting of tall oat grass and Russian thistle that burned very quickly after burning in a blackline along the north edge of the plot and then perimeter firing into the blackline. The wind continued to come out of the southwest.

Photo 64: BR Plot 1 after the burn.

1400 hours: The Project Coordinator notified Range Control that the Rx Crew completed all of the Buds Road plots and would be in route to the three SDSU plots off of Dump Road (Map 5). SDSU prioritized their plots in the event we did not have enough time for all of them and picked the plot furthest from Ridge Road. We reviewed the plan and established the order of vehicles for an escape, if needed. An on-site briefing was held with SDSU Botanist, Emily Howe. These three plots were much larger than the USGS plots at almost 1 acre in size and posed a logistical challenge to spray with PHOS-CHEK Insul-8 gel mix. Since this plot was much larger than the previous ones, a safety briefing was held and a hose deployment strategy was carefully outlined. A Test Burn Plot was flagged, weed whacked, and sprayed with PHOS-CHEK Insul-8 gel/water mix. Range Control was notified we were ready to start the Dump Road Test Plot.

1450 hours: The Dump Road Test Burn went as planned (Photo 65).



Map 5. Location of the three San Diego State University Plots on Dump Road.

Photo 65: The Test Plot burn behaves as anticipated.

1500 hours: The first of the SDSU plots, SDSU Burn Plot 3, was sprayed, which took about an hour to mix and apply several loads of Insul-8 to the weed whacked fireline and outer perimeter (Photo 66). Care was taken not to drag the fire hose through the plot, which meant the hose must be lifted over the plot by an army of hands.

Photo 66: Applying the Insul-8 gel/water mix to the outer perimeter of the north side of the SDSU one acre plot.

1600 hours: Range Control was notified that we were igniting the SDSU Plot. Because of its large size, the plot was strip burned by two burners in tandem (Photos 67–72). The wind was coming out of the west and the burn was started from the eastern edge of the plot. Burning and complete burn out was finished at 1624.

Photo 67: Ignition of SDSU Plot 3 by two burners strip burning in tandem to create a blackline.

Photo 68: The lead burner slowly widens the black line while the second burner fired another strip behind.

Photo 69: As the black line is slowly widened, larger strips are lit and run into the black line.

Photo 70: A text book example of tandem strip burning. The burn was throwing off a large amount of heat.

Photo 71: The holding crew took precautions, due to the amount of time that lapsed since the PHOS-CHEK Insul-8 gel/water mix was applied to the west end of the plot.

Photo 72: The back end of the plot was finished and the plot was allowed to burn out. Burn out is complete at 1624 hours.

1630 hours: The Project Coordinator notified Range Control that burning of SDSU Plot 3 was complete. We start packing up the hose and securing the site. Consideration was given to moving to the next plot when we discovered that the Quick Attack Humvee was down, due to an electrical problem, and would not start. Not having all of the equipment listed on the plan available officially put us out of prescription. In addition, it would have taken us another hour to set up and spray the second plot, making ignition of the plot about 1800 hours. Our weather was starting to slowly deteriorate. We reluctantly made the decision to call an end the day and notified Range Control of our decision.

Day 5, Friday, June 8, 2012

0545 hours: The weather had turned, the windmills were turning and a heavy marine layer covered most of the lower elevations of the island. Flights were scheduled for 1300 hours and it was doubtful that we could complete another plot and get all of our gear cleaned up and ready to take to the Wilson Cove Firehouse for Federal Fire to take down to the Wednesday barge. It took us most of the morning to take the hose we used down to the Crash House, pack our gear, arrange with the shop to have a forklift take the pump off the Navy rental vehicle, power wash the rental vehicles, turn in our radios and Nextel phone to SCORE and arrive at the Terminal in time for flights off SCI.

Thursday, June 14, 2012

0700 hours: At Pier 14 on San Diego Naval Station to retrieve the PHOS-CHEK pump and empty containers of Insul-8 from the barge to take back to Ontario, California (Photo 73).

Photo 73: The PHOS-CHEK pump on route back to Ontario, CA.

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Attachment 6: Prescribed Fire Observations

Site	Plot	Date	Time	ROS Head fire (ft/sec)*	FL (ft max)*	% Burn*	Comments
PGE	10	5-June	1354	0.3	3.5	100	Fired in 5-foot strip perpendicular to wind.
PGE	9	6-June	810	0.7	3.5	98	Fired from center then edges.
PGE	8	6-June	823	0.7	5.5	98	Center firing then edges
PGE	7	6-June	841	0.6	6	100	Blackline top. Fire bottom allowing headfire.
PGE	6	6-June	856	1	6	100	Top blacklined. Bottom headfire.
PGE	5	6-June	904	1.6	7	100	Top blacklined. Bottom headfire.
PGE	4	6-June	917	1.4	8	98	Top blacklined. Bottom headfire.
PGE	3	6-June	925	0.7	8	90	Top blacklined. Bottom headfire.
PGE	2	6-June	944	1	6	100	Firing from southwest corner around edges to northeast corner headfire.
PGE	1	6-June	1000	0.7	5	98	Firing from southwest corner around edges to northeast corner headfire.
PGW	1	6-June	1017	0.6	5	98	Firing from southwest corner around edges to northeast corner with 5-foot strips.
PGW	2	6-June	1113	0.7	8	98	Firing from southwest corner to northeast corner headfire.
PGW	3	6-June	1127	0.8	7	100	Firing from southwest corner to northeast corner in strips of 5 feet.
PGW	4	6-June	1151	0.1	5	95	Firing from southwest corner to northeast corner in strips of 5 feet. Mostly backing fire.
PGW	5	6-June	1208	0.2	6	98	Firing from southwest corner to northeast in narrow strips parallel to the wind
PGW	6	6-June	1228	0.3	5	98	Firing from southwest corner to northeast in narrow strips parallel to the wind
PGW	7	6-June	1417	0.2	5	98	Firing from southeast in strips to the west.
PGW	8	6-June	1440	1	6	98	Firing southwest corner to northeast.
PGW	9	6-June	1509	0.8	8	100	Firing from southwest corner in 5-foot strips. Mostly backing fire.
PGW	10	6-June	1538	1	7	98	Firing from southwest corner to the W in strips of 5 feet wide. Night lizard fatality.
WM	15	7-June	810	0.4	1	50	Firing from northwest corner along sides to headfire from bottom. Avena not cured. Extra fuel added to patches.
WM	14	7-June	828	NM	1	50	Firing from northwest corner along sides to headfire from bottom. Discontinuous burning. ROS not measurable. Fuel added in strips.
WM	13	7-June	837	0.2	1	65	Firing from northwest corner to headfire along bottom. Discontinuous burning.
WM	12	7-June	846	0.1	2	60	Firing from northwest corner to southeast allowing head fire to spread across plot.
WM	1	7-June	856	0.5	2	60	Firing from northwest corner to southeast allowing head fire to spread across plot.
WM	11	7-June	905	0.3	3	70	Firing from northwest corner to southeast allowing head fire to spread across plot.
WM	3	7-June	913	0.06	3	80	Mostly backing fire due to wind shift. Discontinuous burning.
WM	9	7-June	922	0.3	2	65	Firing from northwest corner to southeast allowing head fire to spread across plot.
WM	5	7-June	928	0.5	3	75	Firing from northwest corner to southeast allowing head fire to spread across plot.
WM	7	7-June	935	0.4	2	47	Firing from northwest corner to southeast allowing head fire to spread across plot.
WM	6	7-June	944	0.4	2	50	Firing from northwest corner to southeast allowing head fire to spread across plot.

Site	Plot	Date	Time	ROS Head fire (ft/sec)*	FL (ft max)*	% Burn*	Comments
WM	8	7-June	948	0.3	3	50	Firing from northwest corner to southeast allowing head fire to spread across plot. Backing flame through *Lycium*.
WM	4	7-June	956	0.2	3	65	Firing from southeast corner around edges.
WM	10	7-June	1001	0.2	3	60	Firing from southeast corner around edges.
WM	2	7-June	1005	0.4	3	70	Firing from southeast corner around edges.
BR	15	7-June	1109	0.2	4	45	Firing from northeast corner wrapping fire around edge. Discontinuous burning.
BR	14	7-June	1122	0.3	8	75	Firing from northeast corner. Island night lizard saved. Good consumption of *Lycium*.
BR	13	7-June	1132	0.1	4	55	Firing from northeast corner. Good consumption of *Lycium*.
BR	12	7-June	1146	0.2	4	70	Firing from northeast corner.
BR	11	7-June	1157	1	7	85	Firing from center and edges. Good consumption of *Lycium*.
BR	10	7-June	1233	0.4	6	75	Firing from northeast corner around edges and center.
BR	9	7-June	1246	0.7	6	50	Firing from center.
BR	8	7-June	1302	0.2	7	90	Firing from center. Good consumption of *Lycium*. Minor suppression within plot using dirt and hand tools due to lack of PHOS-CHEK.
BR	7	7-June	1308	NA	3	45	Firing from center. Not continuous burning. No ROS collected. Only *Lycium* patches burn.
BR	6	7-June	1316	0.1	7	40	Firing from center and strips. *Lycium* burning well but no spread.
BR	5	7-June	1321	0.7	2	85	Firing from top edge with strips and head fire from bottom.
BR	4	7-June	1329	0.8	2	70	Firing from top edge with strips and head fire from bottom.
BR	3	7-June	1336	0.6	2	70	Firing from top edge with strips and head fire from bottom. Discontinuous burning.
BR	2	7-June	1345	0.3	3	60	Firing from top edge with strips and head fire from bottom.
BR	1	7-June	1349	0.3	7	85	Firing from top edge with strips and head fire from bottom. Good hot consumption of *Lycium*.

*Data on ROS, FL, and % Burn are courtesy of USGS Technician, Chelsea Morgan